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First record of albinism for the doglike bat, *Peropteryx kappleri* Peters, 1867 (Chiroptera, Emballonuridae)

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Abstract

Albinism is a type of deficient in melanin production could be the result of genetic anomalies that are manifest as the absence of coloration of part or the entire body of an organism. This type of chromatic disorder can affect several vertebrate species, but is rarely found in nature. Among bats, more than 450 cases of total or partial loss of body pigmentation have been reported. Herein we provide the first report of albinism for the bat species *Peropteryx kappleri* (Chiroptera: Emballonuridae) with two such specimens being observed from iron formation caves in a conservation unit "Floresta Nacional de Carajás", Amazon forest, northern of Brazil.

Keywords

Chiroptera, *Peropteryx*, hypopigmentation, Neotropics, Amazonia, cave

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Deficiency in melanin production is a rare among vertebrates. Such a condition can cause changes in the coloration of specific body parts, such as skin, hair, feathers, scales or the eye, and can even reach extreme cases where there is complete absence of pigmentation throughout the entire body. Changes in body color caused by deficient melanin production can generate several conditions, which (Lucati and López-Baucells 2017) has classified into four types: true albinism, leucism, piebaldism and hypomelanism. All types of melanin production deficiency are hereditary and genetic (congenital) abnormalities. Such disorders have been observed in numerous species of wild mammals throughout the world, including marine (Fertl and Rosel 2002, Abreu et al. 2013), terrestrials (Lopucki and Mróz 2010, Abreu et al. 2013, Neves et al. 2013, Xu et al. 2013, Camargo et al. 2014, Nedyalkov et al. 2014, Sayyed et al. 2015, Kumar et al. 2016, Romero et al. 2018, Oliveira et al. 2019) and bats (Uieda 2000, Murariu and Chisamera 2006, McCardle 2012, López-Baucells et al. 2013, Ramasindrazana et al. 2014, Rengifo et al. 2014, Smirnov et al. 2014, Zalapa et. al. 2016, Lucati and López-Baucells 2017).

Chromatic aberrations that lead to albinism in bats have been reported in 61 species of 10 families (Rhinolophidae, Hipposideridae, Rhinopomatidae, Emballonuridae, Nycteridae, Phyllostomidae, Mormoopidae, Molossidae, Miniopteridae, and Vespertilionidae), in a great number of countries worldwide, but they continue to be a rarely observed event (Uieda 2000, Rosa et al. 2017, Nascimento et al. 2018, Zortéa and Silva 2018). Although these aberrations interfere with the coloration of the animals, there have been, to date, no marked negative effects of this genetic inheritance that could compromise the survival of bats in the natural environment (Uieda 2001).

There have been 31 reports of the absence of melanin pigmentation for 17 species of bats in Brazil (Uieda 2000, Rosa et al. 2017, Nascimento et al. 2018, Zortéa and Silva 2018). Of these records, 20 were cases of albinism (t-inherited, hypopigmentary disorder characterized by a complete lack of melanin caused by the absence of the enzyme tyrosinase; it results in pale skin, white fur or feathers, and red eyes) and 11 case of piebaldism (total lack of melanin in part of the skin and/or hair follicles due to the absence of melanocytes in the affected part) (Lucati and López-Baucells 2017; Rosa et al. 2017; Uieda 2000; Zortéa and Silva 2018). This article reports the observations of two albino individuals of *Peropteryx kappleri* Peters, 1867, which increases the number of individual records of albinism in bats in Brazil to 33. Furthermore, it represents the first report of albinism for the genus *Peropteryx* and the third report in the world for the family Emballonuridae (Zortéa and Silva 2018) (Table 1).

The albino bats were observed in Floresta Nacional de Carajás (FLONA-Carajás), which is located completely within the Amazon Forest domain in the state of Pará, North Brazil. (Figure 1). The FLONA Carajás, created by Decree No. 2,486 of February 2, 1998, has more than 390,000 hectares and is a Conservation Unit for sustainable and diversified use of forest resources and scientific research. The main

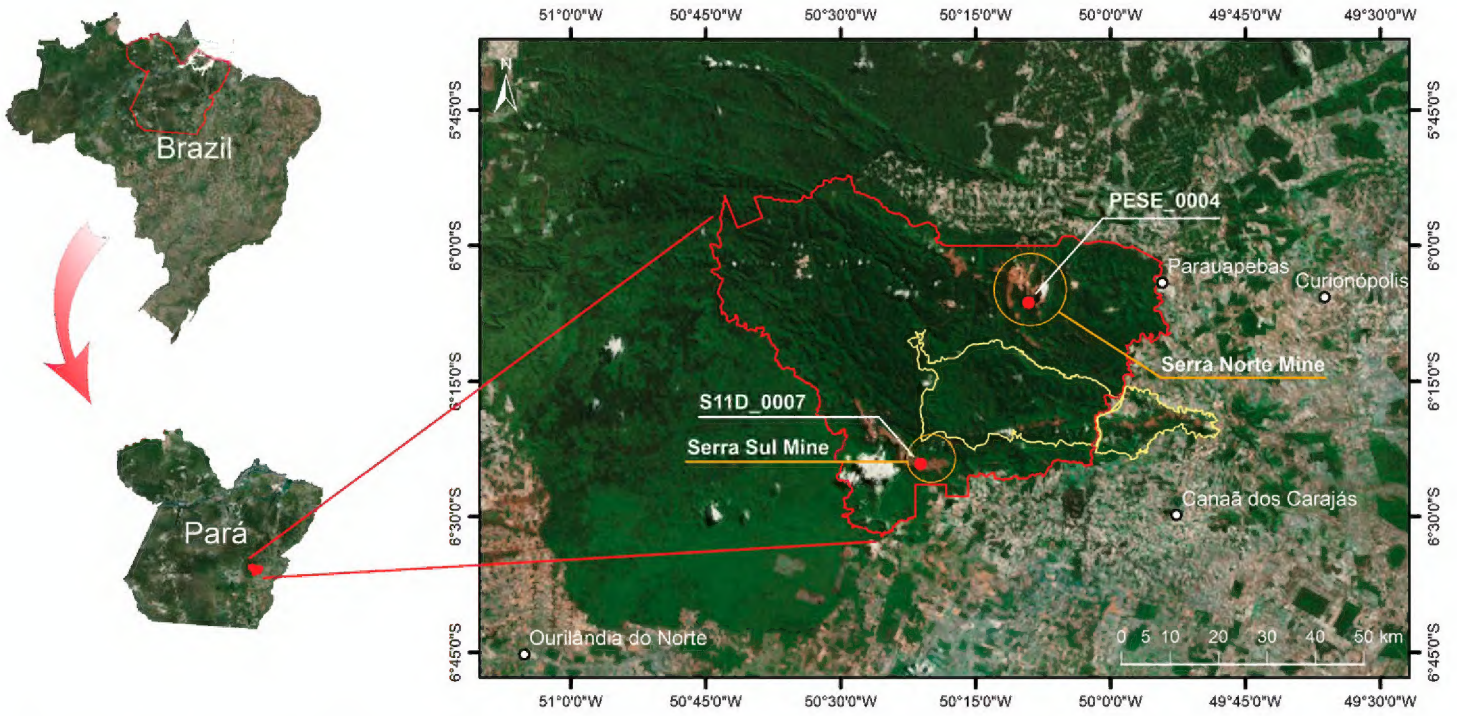

Figure 1. Location of the caves where the specimens of *Peropteryx klaperi* were observed in the municipalities of Parauapebas (cavern PESE–0004) and Canaã dos Carajas (cavern S11D–0007), in southeastern Pará, Brazil.

vegetation cover of the region is the Ombrophilous Forest, with local variations, the majority associated with changes in the relief. The forest areas are intercepted by rock outcrops of iron ore, which has a high economic interest. In these outcrops are concentrated the caves of the region, with mining being the main impact on this important habitat for some species of bats. One of the main purposes for creating FLONA-Carajás was to protect the environment and allow multiple uses of the forest, including the extraction of iron ore in a way that is minimally damaging to the environment, with emphasis on methods for sustainable exploitation of native forests (ICMBIO 2017). However, during the iron ore extraction some caves have been supressed, this proceeds are allowed in this type of conservation unit area. And with the intention of keeping some forest areas and caves undisturbed, was established around of FLONA-Carajás the Carajás Ferruginous Fields National Park, created on June 5, 2017, with 80,000 hectares (Figure 1). In this new protected area are inserted hundreds of caves preserved as an environmental compensation and the iron ore extraction is commercial use of the forest is not allowed.

Species surveys at the site have been routine, but since 2008 faunal studies have intensified in the caves of the region, mainly in association with environmental licensing and monitoring. As a result, knowledge of the local chiropterofauna has increased and to date faunal surveys have been carried out in more than 1,000 caves in FLONA Carajás, in addition to several projects involving the survey of chiroptera in epigeal environments. To date, a total of 75 species of bats have been recorded in FLONA Carajás, of which 23 were recorded in caves, including those of the genus *Peropteryx* (Tavares et al. 2012).

Table 1. Records of albino bats in Brazil.

Species	Disorder	Nº individuals	Location	Reference
Artibeus cinereus	Albinism	1♂	flyway	Oliveira and Aguiar 2008
Artibeus concolor	Piebaldism	1♂	flyway	Zortéa and Silva 2018
Artibeus jamaicensis	Albinism	1?	tree	Uieda 2000
Artibeus planirostris	Albinism	1	–	Uieda 2000
Artibeus lituratus	Piebaldism	1♂	flyway	Souza et al. 2013
Carollia perspicillata	Piebaldism	1♀	cave	Rocha et al. 2013
Carollia perspicillata	Albinism	1♀	flyway	Falcão 2014
Carollia perspicillata	Piebaldism	1♀	flyway	Zortéa and Silva 2018
Carollia perspicillata	Albinism	1?	tunnel	Rosa et al. 2017
Dermanura cinerea	Albinism	1?	–	Oliveira and Aguiar 2008
Desmodus rotundus	Albinism	2♂, 1♀, 1?	1 cave, 1 flyway, 1?	Uieda 2000, 2001
Desmodus rotundus	Albinism	1♂	cave	Uieda 2000, 2001
Desmodus rotundus	Albinism	1?	flyway	Moreira et al. 1992
Eumops glaucinus	Albinism	1♂	–	Sodré et al. 2004
Gardnerycteris crenulatum	Albinism	1	flyway	Zortéa and Silva 2018
Molossus molossus	Albinism	1	hollow tree	Veiga and Oliveira 1995
Molossus molossus	Albinism	1♀	hollow tree	Uieda 2000
Molossus molossus	Albinism	1♀	flyway	Nascimento et al. 2018
Myotis levis	Albinism	1?	–	Miranda et al. 2012
Nyctinomops laticaudatus	Piebaldism	2 ♂, 3 ♀	building	Geiger and Pacheco 2006
Peropteryx kappleri	Albinism	1♂	cave	Present data
Peropteryx kappleri	Albinism	1 young	cave	Present data
Phyllostomus discolor	Piebaldism	1♀	flyway	Treitler et al. 2013
Tadarida brasiliensis	Piebaldism	1?	–	Zortéa and Silva 2018
Tonatia saurophila	Piebaldism	1?	flyway	Zortéa and Silva 2018

The albino bats were observed in 2016 and 2017 in two caves located in FLONA-Carajás; one in a cave in the municipality Parauapebas and the other in the municipality of Canaã dos Carajás, both in the state of Pará, Brazil (Figure 1). The first observation was made on 04 September 2016 and was of an adult male *P. kappleri* found in cave PESE–0004 (06°06'19.22"S; 50°09'5.96"W) (forearm measurement; 47,5 cm). The second observation was made on 23 October 2017 and was of a young *P. kappleri* found in cave S11D–0007 (06°24'06.42"S, 50°21'06.09"W) (no measurements were made).

The specimens were observed hanging on walls inside the caves and last than 5 metres from the entrance. The adult male was solitary, while the juvenile was close to other conspecific individuals with normal coloration. Both individuals had complete albinsm, including reddish eyes, which are typical features of albinism (Figure 2). Aside from the obvious morphological differences of albino bats (i.e., coloration), no other differences were observed for the individuals during the brief period during which they were observed in the field (not more than 30 minutes), not even in their behavior. The observed individuals were not euthanized since the legal authorization of the research only permitted the capture of bats for purposes of identification, with the collection of specimens being allowed only for cases of taxonomic doubt (ABIO 639/2015 and ABIO 455/2014).

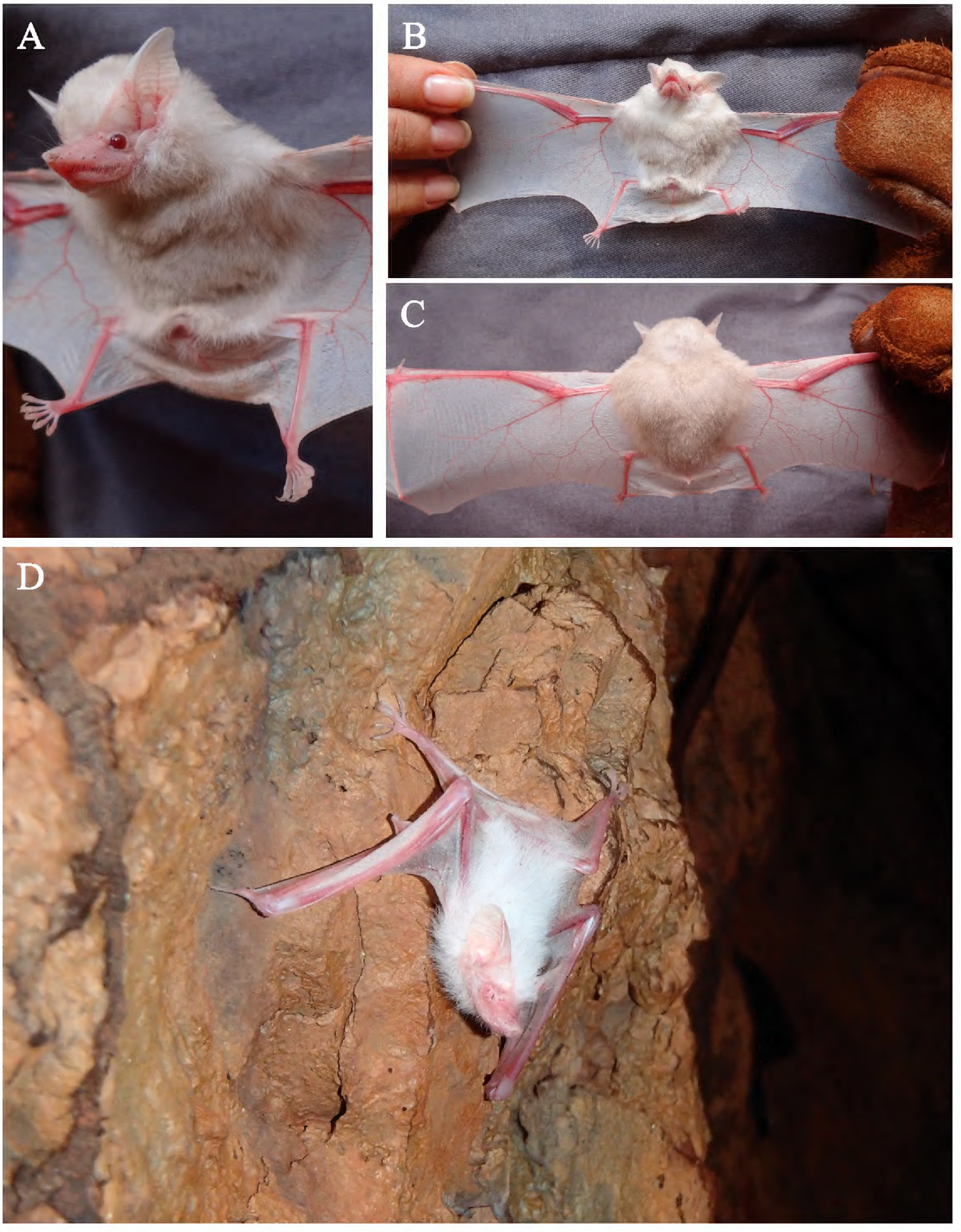

Figure 2. Albino specimens of *Peropteryx* observed in caves of Floresta Nacional de Carajás. **A–C** male specimen of *Peropteryx kappleri* **D** juvenile specimen of *Peropteryx kappleri*.

The adult specimen were captured and measurement were taken to confirm the condition, but the juvenile was simply observed during campaigns to monitor cave fauna.

Bats of the genus *Peropteryx* spp. are very common in the entrances to caves in the region of Carajás, and have been observed in more than 600 caves. Nonetheless,

despite this significant effort, there have been no other reports of albino specimens, which are testimony to the rarity of this condition in this group of animals, as demonstrated by Uieda (2000) and Lucati and López-Baucells (2017), highlighting the importance of these records.

The influence or not of albinism in bat individual fitness should be better evaluated, that's because lack of skin pigmentation could promote a major disadvantage to animals in the wild habitat, the most obvious being an animal's lack of crypsis with its surroundings, protects sun rays and lost of accuracy of eyesight (Uieda 2000, Sandoval-Castilho et al. 2006, Acevedo et al. 2009). However, bat animals have prevalent are nocturnal behaviour so the absence of pigment may not be interfere is significantly with individual fitness. Furthermore, bats seek for a daytime shelter in a variety of habitats, and caves could offer protection against sunlight, water loss, and visual hunting predators (Uieda 2001), promoting better chances to survive.

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